SEQUENCE LISTING

<110> OHTAKI, Hiromi
NAKAMURA, Jun
IZUI, Hiroshi
NAKAMATSU, Tsuyoshi

<120> Bacterium Producing L-Glutamic Acid and Method for Producing L-Glutamic Acid

<130> OP1195

<140>
<141> 2000-07-

<150> JP 2000-204256
<151> 2000-07-05

<160> 34

<170> PatentIn Ver. 2.0

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cgtaccactc cacggaaatt cccg 24

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<220>
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<222> (484)..(1938)

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aaaatcaacc tgcttaggcg tctttcgctt aaatagcgta gaatatcggg tcgatcgctt 120
ttaaacactc aggaggatcc ttgccggcca aaatcacgga cactcgtccc accccagaat 180
cccttcacgc tgttgaagag gaaaccgcag ccggtgcccg caggattgtt gccacctatt 240
ctaaggactt cttcgacggc gtcactttga tgtgcatgct cggcgttgaa cctcagggcc 300
tgcgttacac caaggtcgct tctgaacacg aggaagctca gccaaagaag gctacaaagc 360
ggactcgtaa ggctaccagc taagaaggct gctgctaaga aaacgaccaa gaagaccact 420
aagaaaacta ctaaaaagac caccgcaaag aagaccacaa agaagtctta agccggatct 480
tat atg gat gat tcc aat agc ttt gta gtt gtt gct aac cgt ctg cca 528
Met Asp Asp Ser Asn Ser Phe Val Val Val Ala Asn Arg Leu Pro

1 5 10 15
gtg gat atg act gtc cac cca gat ggt agc tat agc atc tcc ccc agc 576
Val Asp Met Thr Val His Pro Asp Gly Ser Tyr Ser Ile Ser Pro Ser
20 25 30
ccc ggt ggc ctt gtc acg ggg ctt tcc ccc gtt ctg gaa caa cat cgt 624
Pro Gly Gly Leu Val Thr Gly Leu Ser Pro Val Leu Glu Gln His Arg
35 40 45
gga tgt tgg gtc gga tgg cct gga act gta gat gtt gca ccc gaa cca 672
Gly Cys Trp Val Gly Trp Pro Gly Thr Val Asp Val Ala Pro Glu Pro
50 55 60
ttt cga aca gat acg ggt gtt ttg ctg cac cct gtt gtc ctc act gca 720
Phe Arg Thr Asp Thr Gly Val Leu Leu His Pro Val Val Leu Thr Ala
65 70 75
agt gac tat gaa ggc ttc tac gag ggc ttt tca aac gca acg ctg tgg 768
Ser Asp Tyr Glu Gly Phe Tyr Glu Gly Phe Ser Asn Ala Thr Leu Trp
80 85 90 95
cct ctt ttc cac gat ctg att gtt act ccg gtg tac aac acc gat tgg 816
Pro Leu Phe His Asp Leu Ile Val Thr Pro Val Tyr Asn Thr Asp Trp
100 105 110
tgg cat gcg ttt cgg gaa gta aac ctc aag ttc gct gaa gcc gtg agc 864
Trp His Ala Phe Arg Glu Val Asn Leu Lys Phe Ala Glu Ala Val Ser
115 120 125
caa gtg gcg gca cac ggt gcc act gtg tgg gtg cag gac tat cag ctg 912
Gln Val Ala Ala His Gly Ala Thr Val Trp Val Gln Asp Tyr Gln Leu
130 135 140
ttg ctg gtt cct ggc att ttg cgc cag atg cgc ctt gat ttg aag atc 960
Leu Leu Val Pro Gly Ile Leu Arg Gln Met Arg Leu Asp Leu Lys Ile
145 150 155
ggt ttc ttc ctc cac att ccc ttc cct tcc cct gat ctg ttc cgt cag 1008
Gly Phe Phe Leu His Ile Pro Phe Pro Ser Pro Asp Leu Phe Arg Gln
160 165 170 175
ctg ccg tgg cgt gaa gag att gtt cga ggc atg ctg ggc gca gat ttg 1056
Leu Pro Trp Arg Glu Glu Ile Val Arg Gly Met Leu Gly Ala Asp Leu
180 185 190
gtg gga ttc cat ttg gtt caa aac gca gaa aac ttc ctt gcg tta acc 1104
Val Gly Phe His Leu Val Gln Asn Ala Glu Asn Phe Leu Ala Leu Thr
195 200 205
cag cag gtt gcc ggc act gcc ggg tct cat gtg ggt cag ccg gac acc 1152
Gln Gln Val Ala Gly Thr Ala Gly Ser His Val Gly Gln Pro Asp Thr
210 215 220
ttg cag gtc agt ggt gaa gca ttg gtg cgt gag att ggc gct cat gtt 1200

Leu Gln Val Ser Gly Glu Ala Leu Val Arg Glu Ile Gly Ala His Val
225 230 235
gaa acc gct gac gga agg cga gtt agc gtc ggg gcg ttc ccg atc tcg 1248
Glu Thr Ala Asp Gly Arg Arg Val Ser Val Gly Ala Phe Pro Ile Ser
240 245 250 255
att gat gtt gaa atg ttt ggg gag gcg tcg aaa agc gcc gtt ctt gat 1296
Ile Asp Val Glu Met Phe Gly Glu Ala Ser Lys Ser Ala Val Leu Asp
260 265 270
ctt tta aaa acg ctc gac gag ccg gaa acc gta ttc ctg ggc gtt gac 1344
Leu Leu Lys Thr Leu Asp Glu Pro Glu Thr Val Phe Leu Gly Val Asp
275 280 285
cga ctg gac tac acc aag ggc att ttg cag cgc ctg ctt gcg ttt gag 1392
Arg Leu Asp Tyr Thr Lys Gly Ile Leu Gln Arg Leu Leu Ala Phe Glu
290 295 300
gaa ctg ctg gaa tcc ggc gcg ttg gag gcc gac aaa gct gtg ttg ctg 1440
Glu Leu Leu Glu Ser Gly Ala Leu Glu Ala Asp Lys Ala Val Leu Leu
305 310 315
cag gtc gcg acg cct tcg cgt gag cgc att gat cac tat cgt gtg tcg 1488
Gln Val Ala Thr Pro Ser Arg Glu Arg Ile Asp His Tyr Arg Val Ser
320 325 330 335
cgt tcg cag gtc gag gaa gcc gtc ggc cgt atc aat ggt cgt ttc ggt 1536
Arg Ser Gln Val Glu Glu Ala Val Gly Arg Ile Asn Gly Arg Phe Gly
340 345 350
cgc atg ggg cgt ccc gtg gtg cat tat cta cac agg tca ttg agc aaa 1584
Arg Met Gly Arg Pro Val Val His Tyr Leu His Arg Ser Leu Ser Lys
355 360 365
aat gat ctc cag gtg ctg tat acc gca gcc gat gtc atg ctg gtt acg 1632
Asn Asp Leu Gln Val Leu Tyr Thr Ala Ala Asp Val Met Leu Val Thr
370 375 380
cct ttt aaa gac ggt atg aac ttg gtg gct aaa gaa ttc gtg gcc aac 1680
Pro Phe Lys Asp Gly Met Asn Leu Val Ala Lys Glu Phe Val Ala Asn
385 390 395
cac cgc gac ggc act ggt gct ttg gtg ctg tcc gaa ttt gcc ggc gcg 1728
His Arg Asp Gly Thr Gly Ala Leu Val Leu Ser Glu Phe Ala Gly Ala
400 405 410 415
gcc act gag ctg acc ggt gcg tat tta tgc aac cca ttt gat gtg gaa 1776
Ala Thr Glu Leu Thr Gly Ala Tyr Leu Cys Asn Pro Phe Asp Val Glu
420 425 430
tcc atc aaa cgg caa atg gtg gca gct gtc cat gat ttg aag cac aat 1824
Ser Ile Lys Arg Gln Met Val Ala Ala Val His Asp Leu Lys His Asn
435 440 445

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ccg gaa tct gcg gca acg cga atg aaa acg aac agc gag cag gtc tat   1872
Pro Glu Ser Ala Ala Thr Arg Met Lys Thr Asn Ser Glu Gln Val Tyr
        450                 455                 460
acc cac gac gtc aac gtg tgg gct aat agt ttc ctg gat tgt ttg gcg   1920
Thr His Asp Val Asn Val Trp Ala Asn Ser Phe Leu Asp Cys Leu Ala
    465                 470                 475
cag tcg gga gaa aac tca tgaaccgcgc acgaatcgcg accataggcg          1968
Gln Ser Gly Glu Asn Ser
480                 485
ttcttccgct tgctttactg ctggcgtcct gtggttcaga caccgtggaa atgacagatt 2028
ccacctggtt ggtgaccaat atttacaccg atccagatga gtcgaattcg atcagtaatc 2088
ttgtcatttc ccagcccagc ttagattttg gcaattcttc cctgtctggt ttcactggct 2148
gtgtgccttt tacggggcgt gcggaattct tccaaaatgg tgagcaaagc tctgttctgg 2208
atgccgatta tgtgaccttg tcttccctgg atttcgataa acttcccgat gattgccaag 2268
gacaagaact caaagttcat aacgagctgg ttgatcttct gcctggttct tttgaaatct 2328
ccaggacttc tggttcagaa atcttgctga ctagcgatgt c                     2369

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             20                  25                  30
Gly Gly Leu Val Thr Gly Leu Ser Pro Val Leu Glu Gln His Arg Gly
         35                  40                  45
Cys Trp Val Gly Trp Pro Gly Thr Val Asp Val Ala Pro Glu Pro Phe
     50                  55                  60
Arg Thr Asp Thr Gly Val Leu Leu His Pro Val Val Leu Thr Ala Ser
 65                  70                  75                  80
Asp Tyr Glu Gly Phe Tyr Glu Gly Phe Ser Asn Ala Thr Leu Trp Pro
                 85                  90                  95
Leu Phe His Asp Leu Ile Val Thr Pro Val Tyr Asn Thr Asp Trp Trp
            100                 105                 110
His Ala Phe Arg Glu Val Asn Leu Lys Phe Ala Glu Ala Val Ser Gln
        115                 120                 125
Val Ala Ala His Gly Ala Thr Val Trp Val Gln Asp Tyr Gln Leu Leu
    130                 135                 140
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Leu Val Pro Gly Ile Leu Arg Gln Met Arg Leu Asp Leu Lys Ile Gly
145 150 155 160
Phe Phe Leu His Ile Pro Phe Pro Ser Pro Asp Leu Phe Arg Gln Leu
165 170 175
Pro Trp Arg Glu Glu Ile Val Arg Gly Met Leu Gly Ala Asp Leu Val
180 185 190
Gly Phe His Leu Val Gln Asn Ala Glu Asn Phe Leu Ala Leu Thr Gln
195 200 205
Gln Val Ala Gly Thr Ala Gly Ser His Val Gly Gln Pro Asp Thr Leu
210 215 220
Gln Val Ser Gly Glu Ala Leu Val Arg Glu Ile Gly Ala His Val Glu
225 230 235 240
Thr Ala Asp Gly Arg Arg Val Ser Val Gly Ala Phe Pro Ile Ser Ile
245 250 255
Asp Val Glu Met Phe Gly Glu Ala Ser Lys Ser Ala Val Leu Asp Leu
260 265 270
Leu Lys Thr Leu Asp Glu Pro Glu Thr Val Phe Leu Gly Val Asp Arg
275 280 285
Leu Asp Tyr Thr Lys Gly Ile Leu Gln Arg Leu Leu Ala Phe Glu Glu
290 295 300
Leu Leu Glu Ser Gly Ala Leu Glu Ala Asp Lys Ala Val Leu Leu Gln
305 310 315 320
Val Ala Thr Pro Ser Arg Glu Arg Ile Asp His Tyr Arg Val Ser Arg
325 330 335
Ser Gln Val Glu Glu Ala Val Gly Arg Ile Asn Gly Arg Phe Gly Arg
340 345 350
Met Gly Arg Pro Val Val His Tyr Leu His Arg Ser Leu Ser Lys Asn
355 360 365
Asp Leu Gln Val Leu Tyr Thr Ala Ala Asp Val Met Leu Val Thr Pro
370 375 380
Phe Lys Asp Gly Met Asn Leu Val Ala Lys Glu Phe Val Ala Asn His
385 390 395 400
Arg Asp Gly Thr Gly Ala Leu Val Leu Ser Glu Phe Ala Gly Ala Ala
405 410 415
Thr Glu Leu Thr Gly Ala Tyr Leu Cys Asn Pro Phe Asp Val Glu Ser
420 425 430
Ile Lys Arg Gln Met Val Ala Ala Val His Asp Leu Lys His Asn Pro
435 440 445
Glu Ser Ala Ala Thr Arg Met Lys Thr Asn Ser Glu Gln Val Tyr Thr
450 455 460
His Asp Val Asn Val Trp Ala Asn Ser Phe Leu Asp Cys Leu Ala Gln

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Ser Gly Glu Asn Ser
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<213> Brevibacterium lactofermentum

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<222> (82)..(2514)

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aacttttaag ggtgtttcat c atg gca cgt cca att tcc gca acg tac agg   111
                       Met Ala Arg Pro Ile Ser Ala Thr Tyr Arg
                         1               5                  10
ctt caa atg cga gga cct caa gca gat agc gcc ggg cgt ttc ttt ggt   159
Leu Gln Met Arg Gly Pro Gln Ala Asp Ser Ala Gly Arg Phe Phe Gly
                15                  20                  25
ttt gcg cag gcc aaa gcc cag ctt ccc tat ctg aag aag cta ggc atc   207
Phe Ala Gln Ala Lys Ala Gln Leu Pro Tyr Leu Lys Lys Leu Gly Ile
            30                  35                  40
agc cac ctg tac ctc tcc cct att ttt acg gcc atg cca gat tcc aat   255
Ser His Leu Tyr Leu Ser Pro Ile Phe Thr Ala Met Pro Asp Ser Asn
        45                  50                  55
cat ggc tac gat gtc att gat ccc acc gcc atc aat gaa gag ctc ggt   303
His Gly Tyr Asp Val Ile Asp Pro Thr Ala Ile Asn Glu Glu Leu Gly
    60                  65                  70
ggc atg gag ggt ctt cga gat ctt gct gca gct aca cac gag ttg ggc   351
Gly Met Glu Gly Leu Arg Asp Leu Ala Ala Ala Thr His Glu Leu Gly
 75                  80                  85                  90
atg ggc atc atc att gat att gtt ccc aac cat tta ggt gtt gcc gtt   399
Met Gly Ile Ile Ile Asp Ile Val Pro Asn His Leu Gly Val Ala Val
                95                  100                 105
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cca cat ttg aat cct tgg tgg tgg gat gtt cta aaa aac ggc aaa gat    447
Pro His Leu Asn Pro Trp Trp Trp Asp Val Leu Lys Asn Gly Lys Asp
            110                 115                 120
tcc gct ttt gag ttc tat ttc gat att gac tgg cac gaa gac aac ggt    495
Ser Ala Phe Glu Phe Tyr Phe Asp Ile Asp Trp His Glu Asp Asn Gly
        125                 130                 135
tct ggt ggc aag ctg ggc atg ccg att ctg ggt gct gaa ggc gat gaa    543
Ser Gly Gly Lys Leu Gly Met Pro Ile Leu Gly Ala Glu Gly Asp Glu
    140                 145                 150
gac aag ctg gaa ttc gcg gag ctt gat gga gag aaa gtg ctc aaa tat    591
Asp Lys Leu Glu Phe Ala Glu Leu Asp Gly Glu Lys Val Leu Lys Tyr
155                 160                 165                 170
ttt gac cac ctc ttc cca atc gcg cct ggt acc gaa gaa ggg aca ccg    639
Phe Asp His Leu Phe Pro Ile Ala Pro Gly Thr Glu Glu Gly Thr Pro
                175                 180                 185
caa gaa gtc tac aag cgc cag cat tac cgc ctg cag ttc tgg cgc gac    687
Gln Glu Val Tyr Lys Arg Gln His Tyr Arg Leu Gln Phe Trp Arg Asp
            190                 195                 200
ggc gtg atc aac ttc cgt cgc ttc ttt tcc gtg aat acg ttg gct ggc    735
Gly Val Ile Asn Phe Arg Arg Phe Phe Ser Val Asn Thr Leu Ala Gly
        205                 210                 215
atc agg caa gaa gat ccc ttg gtg ttt gaa cat act cat cgt ctg ctg    783
Ile Arg Gln Glu Asp Pro Leu Val Phe Glu His Thr His Arg Leu Leu
    220                 225                 230
cgc gaa ttg gtg gcg gaa gac ctc att gac ggc gtg cgc gtc gat cac    831
Arg Glu Leu Val Ala Glu Asp Leu Ile Asp Gly Val Arg Val Asp His
235                 240                 245                 250
ccc gac ggg ctt tcc gat cct ttt gga tat ctg cac aga ctc cgc gac    879
Pro Asp Gly Leu Ser Asp Pro Phe Gly Tyr Leu His Arg Leu Arg Asp
                255                 260                 265
ctc att gga cct gac cgc tgg ctg atc atc gaa aag atc ttg agc gtt    927
Leu Ile Gly Pro Asp Arg Trp Leu Ile Ile Glu Lys Ile Leu Ser Val
            270                 275                 280
gat gaa cca ctc gat ccc cgc ctg gcc gtt gat ggc acc act ggc tac    975
Asp Glu Pro Leu Asp Pro Arg Leu Ala Val Asp Gly Thr Thr Gly Tyr
        285                 290                 295
gac ccc ctc cgt gaa ctc gac ggc gtg ttt atc tcc cga gaa tct gag    1023
Asp Pro Leu Arg Glu Leu Asp Gly Val Phe Ile Ser Arg Glu Ser Glu
    300                 305                 310
gac aaa ttc tcc atg ttg gcg ctg acc cac agt gga tcc acc tgg gat    1071
Asp Lys Phe Ser Met Leu Ala Leu Thr His Ser Gly Ser Thr Trp Asp
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315 320 325 330
gaa cgc gcc cta aaa tcc acg gag gaa agc ctc aaa cga gtc gtc gcg 1119
Glu Arg Ala Leu Lys Ser Thr Glu Glu Ser Leu Lys Arg Val Val Ala
335 340 345
caa caa gaa ctc gca gcc gaa atc tta agg ctc gcc cgc gcc atg cgc 1167
Gln Gln Glu Leu Ala Ala Glu Ile Leu Arg Leu Ala Arg Ala Met Arg
350 355 360
cgc gat aac ttc tcc acc gca ggc acc aac gtc acc gaa gac aaa ctt 1215
Arg Asp Asn Phe Ser Thr Ala Gly Thr Asn Val Thr Glu Asp Lys Leu
365 370 375
agc gaa acc atc atc gaa tta gtc gcc gcc atg ccc gtc tac cgc gcc 1263
Ser Glu Thr Ile Ile Glu Leu Val Ala Ala Met Pro Val Tyr Arg Ala
380 385 390
gac tac atc tcc ctc tca cgc acc acc gcc acc gtc atc gcg gag atg 1311
Asp Tyr Ile Ser Leu Ser Arg Thr Thr Ala Thr Val Ile Ala Glu Met
395 400 405 410
tcc aaa cgc ttc ccc tcc cgg cgc gac gca ctc gac ctc atc tcg gcc 1359
Ser Lys Arg Phe Pro Ser Arg Arg Asp Ala Leu Asp Leu Ile Ser Ala
415 420 425
gcc cta ctt ggc aat ggc gag gcc aaa atc cgc ttc gcc caa gtc tgc 1407
Ala Leu Leu Gly Asn Gly Glu Ala Lys Ile Arg Phe Ala Gln Val Cys
430 435 440
ggc gcc gtc atg gcc aaa ggt gtg gaa gac acc acc ttc tac cgc gca 1455
Gly Ala Val Met Ala Lys Gly Val Glu Asp Thr Thr Phe Tyr Arg Ala
445 450 455
tct agg ctc gtt gca ctg caa gaa gtc ggt ggc gcg ccg ggc agg ttc 1503
Ser Arg Leu Val Ala Leu Gln Glu Val Gly Gly Ala Pro Gly Arg Phe
460 465 470
ggc gtc tcc gct gca gaa ttc cac ttg ctg cag gaa gaa cgc agc ctg 1551
Gly Val Ser Ala Ala Glu Phe His Leu Leu Gln Glu Glu Arg Ser Leu
475 480 485 490
ctg tgg cca cgc acc atg acc acc ttg tcc acg cac gac acc aaa cgc 1599
Leu Trp Pro Arg Thr Met Thr Thr Leu Ser Thr His Asp Thr Lys Arg
495 500 505
ggc gaa gat acc cgc gcc cgc atc atc tcc ctg tcc gaa gtc ccc gat 1647
Gly Glu Asp Thr Arg Ala Arg Ile Ile Ser Leu Ser Glu Val Pro Asp
510 515 520
atg tac tcc gag ctg gtc aat cgt gtt ttc gca gtg ctc ccc gcg cca 1695
Met Tyr Ser Glu Leu Val Asn Arg Val Phe Ala Val Leu Pro Ala Pro
525 530 535
gac ggc gca acg ggc agt ttc ctc cta caa aac ctg ctg ggc gta tgg 1743

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Asp Gly Ala Thr Gly Ser Phe Leu Leu Gln Asn Leu Leu Gly Val Trp
    540                 545                 550
ccc gcc gac ggc gtg atc acc gat gcg ctg cgc gat cga ttc agg gaa   1791
Pro Ala Asp Gly Val Ile Thr Asp Ala Leu Arg Asp Arg Phe Arg Glu
555                 560                 565                 570
tac gcc cta aaa gct atc cgc gaa gca tcc aca aaa acc acg tgg gtg   1839
Tyr Ala Leu Lys Ala Ile Arg Glu Ala Ser Thr Lys Thr Thr Trp Val
                575                 580                 585
gac ccc aac gag tcc ttc gag gct gcg gtc tgc gat tgg gtg gaa gcg   1887
Asp Pro Asn Glu Ser Phe Glu Ala Ala Val Cys Asp Trp Val Glu Ala
            590                 595                 600
ctt ttc gac gga ccc tcc acc tca tta atc acc gaa ttt gtc tcc cac   1935
Leu Phe Asp Gly Pro Ser Thr Ser Leu Ile Thr Glu Phe Val Ser His
        605                 610                 615
atc aac cgt ggc tct gtg aat atc tcc tta ggt agg aaa ctg ctg caa   1983
Ile Asn Arg Gly Ser Val Asn Ile Ser Leu Gly Arg Lys Leu Leu Gln
    620                 625                 630
atg gtg ggc gct gga atc ccc gac act tac caa gga act gag ttt tta   2031
Met Val Gly Ala Gly Ile Pro Asp Thr Tyr Gln Gly Thr Glu Phe Leu
635                 640                 645                 650
gaa gac tcc ctg gta gat ccc gat aac cga cgc ttt gtt gat tac acc   2079
Glu Asp Ser Leu Val Asp Pro Asp Asn Arg Arg Phe Val Asp Tyr Thr
                655                 660                 665
gcc aga gaa caa gtc ctg gag cgc ctg caa acc tgg gat tgg acg cag   2127
Ala Arg Glu Gln Val Leu Glu Arg Leu Gln Thr Trp Asp Trp Thr Gln
            670                 675                 680
gtt aat tcg gta gaa gac ttg gtg gat aac gcc gac atc gcc aaa atg   2175
Val Asn Ser Val Glu Asp Leu Val Asp Asn Ala Asp Ile Ala Lys Met
        685                 690                 695
gcc gtg gtc cat aaa tcc ctc gag ttg cgt gct gaa ttt cgt gca agc   2223
Ala Val Val His Lys Ser Leu Glu Leu Arg Ala Glu Phe Arg Ala Ser
    700                 705                 710
ttt gtt ggt gga gat cat cag gca gta ttt ggc gaa ggt cgc gca gaa   2271
Phe Val Gly Gly Asp His Gln Ala Val Phe Gly Glu Gly Arg Ala Glu
715                 720                 725                 730
tcc cac atc atg ggc atc gcc cgc ggt aca gac cga aac cac ctc aac   2319
Ser His Ile Met Gly Ile Ala Arg Gly Thr Asp Arg Asn His Leu Asn
                735                 740                 745
atc att gct ctt gct acc cgt cga cca ctg atc ttg gaa gac cgt ggc   2367
Ile Ile Ala Leu Ala Thr Arg Arg Pro Leu Ile Leu Glu Asp Arg Gly
            750                 755                 760
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gga tgg tat gac acc acc gtc acg ctt cct ggt gga caa tgg gaa gac   2415
Gly Trp Tyr Asp Thr Thr Val Thr Leu Pro Gly Gly Gln Trp Glu Asp
        765                 770                 775
agg ctc acc ggg caa cgc ttc agt ggt gtt gtc cca gcc acc gat ttg   2463
Arg Leu Thr Gly Gln Arg Phe Ser Gly Val Val Pro Ala Thr Asp Leu
    780                 785                 790
ttc tca cat tta ccc gta tct ttg ttg gtt tta gta ccc gat agt gag   2511
Phe Ser His Leu Pro Val Ser Leu Leu Val Leu Val Pro Asp Ser Glu
795                 800                 805                 810
ttt tgatccctgc acaggaaagt tagcggcgct actatgaacg atcgatatgt        2564
Phe
ctgacaacac tctctcccaa tttggcagtt actaccacga attccgacgt gcccatccca 2624
tggccgacgt cgaattcctc ctagcaattg aagaattact cacagacggt ggtgtcacct 2684
tcgatcgcgt caccacacgc atcaaagaat ggtcaagcct gaaagccaag gctcgcaagc 2744
gtcgcgacga tggctcgttg atctaccctg atccgcgcaa agacatccac gacatgatcg 2804
gtgttcggat caccacgtac cactccacgg aaattcccgt ggccttaaaa gtgctccaag 2864
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<213> Brevibacterium lactofermentum

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Gln Ala Asp Ser Ala Gly Arg Phe Phe Gly Phe Ala Gln Ala Lys Ala
             20                  25                  30
Gln Leu Pro Tyr Leu Lys Lys Leu Gly Ile Ser His Leu Tyr Leu Ser
         35                  40                  45
Pro Ile Phe Thr Ala Met Pro Asp Ser Asn His Gly Tyr Asp Val Ile
     50                  55                  60
Asp Pro Thr Ala Ile Asn Glu Glu Leu Gly Gly Met Glu Gly Leu Arg
 65                  70                  75                  80
Asp Leu Ala Ala Ala Thr His Glu Leu Gly Met Gly Ile Ile Ile Asp
                 85                  90                  95
Ile Val Pro Asn His Leu Gly Val Ala Val Pro His Leu Asn Pro Trp
            100                 105                 110
Trp Trp Asp Val Leu Lys Asn Gly Lys Asp Ser Ala Phe Glu Phe Tyr
        115                 120                 125
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Phe Asp Ile Asp Trp His Glu Asp Asn Gly Ser Gly Gly Lys Leu Gly
130 135 140
Met Pro Ile Leu Gly Ala Glu Gly Asp Glu Asp Lys Leu Glu Phe Ala
145 150 155 160
Glu Leu Asp Gly Glu Lys Val Leu Lys Tyr Phe Asp His Leu Phe Pro
165 170 175
Ile Ala Pro Gly Thr Glu Glu Gly Thr Pro Gln Glu Val Tyr Lys Arg
180 185 190
Gln His Tyr Arg Leu Gln Phe Trp Arg Asp Gly Val Ile Asn Phe Arg
195 200 205
Arg Phe Phe Ser Val Asn Thr Leu Ala Gly Ile Arg Gln Glu Asp Pro
210 215 220
Leu Val Phe Glu His Thr His Arg Leu Leu Arg Glu Leu Val Ala Glu
225 230 235 240
Asp Leu Ile Asp Gly Val Arg Val Asp His Pro Asp Gly Leu Ser Asp
245 250 255
Pro Phe Gly Tyr Leu His Arg Leu Arg Asp Leu Ile Gly Pro Asp Arg
260 265 270
Trp Leu Ile Ile Glu Lys Ile Leu Ser Val Asp Glu Pro Leu Asp Pro
275 280 285
Arg Leu Ala Val Asp Gly Thr Thr Gly Tyr Asp Pro Leu Arg Glu Leu
290 295 300
Asp Gly Val Phe Ile Ser Arg Glu Ser Glu Asp Lys Phe Ser Met Leu
305 310 315 320
Ala Leu Thr His Ser Gly Ser Thr Trp Asp Glu Arg Ala Leu Lys Ser
325 330 335
Thr Glu Glu Ser Leu Lys Arg Val Val Ala Gln Gln Glu Leu Ala Ala
340 345 350
Glu Ile Leu Arg Leu Ala Arg Ala Met Arg Arg Asp Asn Phe Ser Thr
355 360 365
Ala Gly Thr Asn Val Thr Glu Asp Lys Leu Ser Glu Thr Ile Ile Glu
370 375 380
Leu Val Ala Ala Met Pro Val Tyr Arg Ala Asp Tyr Ile Ser Leu Ser
385 390 395 400
Arg Thr Thr Ala Thr Val Ile Ala Glu Met Ser Lys Arg Phe Pro Ser
405 410 415
Arg Arg Asp Ala Leu Asp Leu Ile Ser Ala Ala Leu Leu Gly Asn Gly
420 425 430
Glu Ala Lys Ile Arg Phe Ala Gln Val Cys Gly Ala Val Met Ala Lys
435 440 445
Gly Val Glu Asp Thr Thr Phe Tyr Arg Ala Ser Arg Leu Val Ala Leu

450 455 460
Gln Glu Val Gly Gly Ala Pro Gly Arg Phe Gly Val Ser Ala Ala Glu
465 470 475 480
Phe His Leu Leu Gln Glu Glu Arg Ser Leu Leu Trp Pro Arg Thr Met
485 490 495
Thr Thr Leu Ser Thr His Asp Thr Lys Arg Gly Glu Asp Thr Arg Ala
500 505 510
Arg Ile Ile Ser Leu Ser Glu Val Pro Asp Met Tyr Ser Glu Leu Val
515 520 525
Asn Arg Val Phe Ala Val Leu Pro Ala Pro Asp Gly Ala Thr Gly Ser
530 535 540
Phe Leu Leu Gln Asn Leu Leu Gly Val Trp Pro Ala Asp Gly Val Ile
545 550 555 560
Thr Asp Ala Leu Arg Asp Arg Phe Arg Glu Tyr Ala Leu Lys Ala Ile
565 570 575
Arg Glu Ala Ser Thr Lys Thr Thr Trp Val Asp Pro Asn Glu Ser Phe
580 585 590
Glu Ala Ala Val Cys Asp Trp Val Glu Ala Leu Phe Asp Gly Pro Ser
595 600 605
Thr Ser Leu Ile Thr Glu Phe Val Ser His Ile Asn Arg Gly Ser Val
610 615 620
Asn Ile Ser Leu Gly Arg Lys Leu Leu Gln Met Val Gly Ala Gly Ile
625 630 635 640
Pro Asp Thr Tyr Gln Gly Thr Glu Phe Leu Glu Asp Ser Leu Val Asp
645 650 655
Pro Asp Asn Arg Arg Phe Val Asp Tyr Thr Ala Arg Glu Gln Val Leu
660 665 670
Glu Arg Leu Gln Thr Trp Asp Trp Thr Gln Val Asn Ser Val Glu Asp
675 680 685
Leu Val Asp Asn Ala Asp Ile Ala Lys Met Ala Val Val His Lys Ser
690 695 700
Leu Glu Leu Arg Ala Glu Phe Arg Ala Ser Phe Val Gly Gly Asp His
705 710 715 720
Gln Ala Val Phe Gly Glu Gly Arg Ala Glu Ser His Ile Met Gly Ile
725 730 735
Ala Arg Gly Thr Asp Arg Asn His Leu Asn Ile Ile Ala Leu Ala Thr
740 745 750
Arg Arg Pro Leu Ile Leu Glu Asp Arg Gly Gly Trp Tyr Asp Thr Thr
755 760 765
Val Thr Leu Pro Gly Gly Gln Trp Glu Asp Arg Leu Thr Gly Gln Arg
770 775 780

Phe Ser Gly Val Val Pro Ala Thr Asp Leu Phe Ser His Leu Pro Val
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Ser Leu Leu Val Leu Val Pro Asp Ser Glu Phe
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<212> DNA
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ccaaaatcga taacatcaat cgagatcggg 30

<210> 34
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: primer for PCR

<400> 34
cttgatcgat taaaaacgct cgacgagccg 30